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08/781,920	12/30/1996	TAKESHI FUKUNAGA	0756-1614	8849

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ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 08/781,920	Applicant(s) Fukunaga et al
	Examiner M.L. Padgett	Group Art Unit 1762

—The MAILING DATE of this communication appears on the cover sheet beneath th correspondence address—

P riod for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _____ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 1/28/02 (12/21/01).

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 24-92 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 24-92 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Pri rity under 35 U.S.C. § 119 (a)–(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)–(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____ .

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____ .

Atta hment(s)

☒ Information Disclosure Statement(s), PTO–1449, Paper No(s). 45

☐ Interview Summary, PTO–413

☐ Notice of Referenc (s) Cited, PTO–892

☐ Notice of Informal Pat nt Application, PTO–152

☐ Notice of Draftsperson's Patent Drawing R view, PTO–948

☐ Other _____

Office Action Summary

1. Claim 24, 31, 32, 40, 49, 50, 55 and 66-92 are objected to or under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Use of undefined abbreviations or acronyms in claims is improper, and on first occurance it should be defined by writing it out in full. "CPU" in claims 71-75 was defined on p. 9 of applicants' 1/28/02 response as "control processing unit". The term was found used in lists on p. 38-39, but with no defining definition, hence should also be defined on its first use in the specification.

New claims 66-70 are like wise objected for having the undefined acronym "LDD" in lines 2. The examiner notes that on p. 37, lines 24-25 the meaning if this term is given as "lightly doped drain", which if inserted in the claims would include a relative term, without any limits to define it, unless a prior art definition with metes and bounds is provided.

Use of relative terms in vague and indefinite unless they are defined by limits in the claim, or by a definitive definition in the specification, or in relavent cited prior art. Such relative terms include "lightly" which is implied to be in claims 66-70, and "momentarily" in claims 31, 40, 49 and 55. No definition of what might be meant by momentarily was found in the specification, as no use of the term was found. Page 18, which discusses "fused" in a situation other than that claimed if NOT modified by "momentarily". In the new claims 76-92, see "rapid" and "strong".

It remains unclear what applicant intends by fusing an already crystallized surface with a laser, especially there is no discussion thereof in the original specification.

In the independent claims 24, 32, 50 and 76 are objected to being amended to contain non-idiomatic English, "... to proceed further crystallization". The previously claimed "promote" made sense, so does just deleting it as in claim 4 but "proceed" does not.

2. Claim 31, 40, 49, 55 and 70-92 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Pages 17-18 which discuss "fused" in an example using a Ni-containing layer, imparts the crystallinity by using the combination of both heat and irradiation simultaneously, so provides no support for the claimed "momentarily fuses", with previous crystallization. In embodiment 2 on p. 20, where heating and irradiation are done sequentially, no fusing is discussed. The original claims did not discuss fusing, hence claims 31, 40, 49 and 55 now contain new matter (both the momentarily and the fuses) for the claims as written.

There is NO disclosure of the invention that crystallizes the semiconductor layer without the use of "a catalyst element" at the broadest disclosure (abstract; Summary p. 6-7), hence all the new claims 76-92 contain New Matter. Claim 84 almost overcomes this problem, except "a material for promoting crystallization" is broader than the generic disclosure of "a catalyst element", as it includes compounds that may be catalytic, i.e. promote crystallization, instead of just elements. Note that supplying the catalytic element in a compound, is not the same as thing, because it is still the element, not the form its supplied in that is critical. Therefore, claim 84 and its dependants are still broader than the scope of the enabling disclosure, hence contain New Matter.

On page 11, where the desirability of heat treating before or after laser treatment is discussed, "strong light" exemplified only by infrared light (IR) is taught as an alternative to laser light, not as the heat source for the disclosed heat treating from 450-750°C. All examples using light, illustrated in Fig. 8 (and repeatedly discussed) use Ni catalysts, hence provide NO support for applicants' new claims.

The only example or discussion found combining laser light and IR, was embodiment 4 on p. 26-28 (+), where Ni catalyst was used, and initial crystallization involved scanning with laser light simultaneously with heating to 550°C, then 1.2 μm IR light was used to enhance the crystallization. Thereafter a further heat treatment was preformed at 550°C for 4 hrs in N_2 to reduce defects. Only after this long heating are patterning and subsequent steps preformed. This Example fails to provide support for applicants broadly claimed procedures that do not use Ni as a catalyst, or any catalyst; do not heat with the laser, and claim generic rapid thermal annealing (RTA) instead of IR, follows by a long thermal annealing process.

3. Claims 76-92 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for various combinations of laser/light and heat treatment crystallization processes using a catalytic element to promote or accelerate crystallization, does not reasonably provide enablement for crystallization without the catalyst, or without heat other than RTA supplied during the sequence of crystallization steps (see above section 2). The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. See the above discussion of New Matter.

4. The previously rejected New Matter of claims 24-75 appears to have been removed, although claims 31, 40, 49 and 55 now contain a new or modified version of New Matter, therefore all of 24-75 except these claims are now given the benefit of the certified translation and its priority date. Note that a terminal disclaim is still required to remove a judicial double patenting rejection.

New claims 76-92, which are replete with new matter, do not have the benefit of the foreign priority date provided by the certified translation.

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claims 31, 40, 49, 50 and 76-92 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohtani et al (5,543,352) in view of Zhang et al (5,529,937) or visa versa, optionally in view of Liu et al (826) or Zhang et al (291). See below.

Claims 76-78, 80-82, 84-86, 88-90 and 92 are rejected under 35 U.S.C. 102(e) as being clearly anticipate by Ohtani et al (352).

Claims 24-75 rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 5,543,352 to Ohtani et al, in view of Zhang et al (937), optionally further in view of Liu et al (826) or Zhang et al (291).

Note that if all the NEW Matter was removed from the claims the certified translation of JP. Ap. No. 6-225851 would be effective, also for claims 31, 40, 49, and 50.

Ohtani et al claim (hence teach) all aspects of applicant's claims, except the second thermal heating step; the formation of a transistor with channels ((applicants' claims 41-49), but that is taught in example 3 on col. 10, lines 38-48 for 102/103 purposes); the claimed step whose meaning is not particularly clear or supported, but may be considered covered by teachings of light (IR) or laser light used in the same fashion; and the claimed patterning to form

semiconductor islands (applicants' claims 50-55), but such is suggested by example 4 called 5 on col. 11, lines 54-65. Ohtani's Claim 16 generically improves the crystallization with light, while 17 specifies laser and 18 IR. Claims 1 & 15 suggest laser or intense light. The specification of Ohtani et al (ie. for the 103 rejection) explicitly teaches the use of excimer lasers, which are inherently pulsed lasers, in a nitrogen atmosphere for use in the laser irradiation step of crystallization. See col. 4, lines 36-61; col. 7, lines 10-15 in Ex. 1 (KrF excimer laser or IR ray); col. 8 lines 1-8 in Ex. 2; col. 13, lines 16-28 in Ex. 5; and col. 15, lines 1-8 in Ex. 6 for use of various excimer lasers (KrF and XeCl) as claimed. It is further noted that Ex. 3 on col.10, lines 38-45; Ex. 4 (called 5) in col. 12, lines 55-60; Ex. 5 in col. 14, lines 40-42 and Ex. 6 on col. 16, lines 5-8 teach annealing the final TFT devices produced in a hydrogen atmosphere, under conditions and circumstances as taught in applicant's specification.

With respect to the new claims 76-92, note that besides teaching IR as an alternative to laser light in the crystallization sequence, further processing steps, may also employ laser or IR annealing. Particularly note Ex. 3 of Ohtani et al which uses heating, then a KrF excimer laser during the initial crystallization, then after patterning and doping performs annealing with laser or RTA using IR (col. 9, lines 1-20 and col. 10, lines 1-19), thus reading on the claims, as the comprising language does not exclude intervening steps.

The patent Zhang et al ('937) teaches and claims a very similar process with many overlapping steps, however it also teaches heating of the silicon film before, during and possibly after the irradiation step. Particularly see, claim 56, or col. 8, lines 12-23, or col. 15, lines 18-51 and Figure 5, where 3 periods of heating are discussed in relationship to the light irradiation step, such that the third step with 200-500°C corresponds to applicants' claimed second heating, with

overlapping temperature ranges. The irradiation step in Zhang et al (937) may use either IR or laser light to promote further crystallization (col. 7, lines 60-67; col. 9, lines 46-59; col. 12, lines 20-24), but the specific type of laser used at that step is not specified, however later laser anneal steps (after doping) applied to the Si film use eximer lasers (ie. pulsed), hence it would have been obvious to one of ordinary skill in the art to use the same types of lasers in the early steps or in Ohtani et al's irradiating claims, because in both instances lasers are used to effect the crystallization of the silicon film in analogous fashions. Also, as indicated by claim 56, two separate light irradiation steps occur during the 3 part heating, and both Zhang et al and Ohtani et al teach laser and IR as alternatives, hence it would have been obvious to one of ordinary skill in the art to employ either or both laser and IR light techniques in the sequence described in Zhang et al (937)'s claim 56. See col. 10, lines 42-51 and col. 16, lines 49-58 for KrF lasers and parameters used for annealing the Si film. Zhang et al (937)'s claims, such as 12, appear to be after or possibly during the irradiation, but have unclear temporal language. It would have been obvious to one of ordinary skill in the art to apply such heating in the Ohtani et al reference due to the similarities of the processes and taught benefit of reducing defects and dangling bonds. Zhang et al particularly teach the use of nitrogen in the initial heating to crystallize and after irradiation H_2 ambient instead of N_2 as claimed by applicant's present claims 25, 33, 42 and 51 in order to neutralize dangling bonds (col. 7, lines 52-59; col. 8, lines 19-30; col. 9, lines 15-59 and col. 11, lines 11-16; etc.), however inert atmospheres would also have been expected to be effective as they are conventionally used for annealing procedures, hence would have been expected to have been effective especially considering the initial use of N_2 when heating to crystallize. Alternatively, Zhang et al (291) or Liu et al (826) teach the use of Ar or other inert

atmospheres for Ni or Pd-catalyzed annealing procedures of Si films at temperatures within the presently claimed range, although slightly higher than the Zhang et al ('937) third temperatures (col. 4, lines 20-48 and Ex. 2). Liu et al thus provides cumulative evidence that inert atmospheres, hence N_2 would have been expected to be effective for the annealing of Ohtani et al in view of Zhang et al (937) and Liu et al.

The use of H_2 gas when annealing after irradiation in Zhang et al (937) would have made a subsequent (previously claimed) H-anneal step further obvious in Ohtani et al due to the explicit teaching on the effects on any dangling bonds that may remain, but use of hydrogen at this point is no longer an issue.

Zhang et al (937) also teach use of their products, as claimed, with patterning producing island like semiconductor regions (col. 13, lines 13-22), and for producing channel forming areas in transistor devices (col. 13, lines 52-64 & col. 15, line 52-col. 16, line 13), hence use of the analogous features in an Ohtani et al product for such would have been obvious. As semiconductor substrates typically have a multiplicity of features, forming a plurality would have been standard procedure, hence obvious.

As noted above, claims 25, 33, 42 and 57 differ by requiring their atmosphere to be N_2, however Zhang et al (291) shows that for annealing semiconductors using heat, that N_2 is known to be an inactive atmosphere, hence obvious in view of the annealing procedures of the primary references, which are also a heat treating α-Si to cause crystallization. In Zhang et al (291), see abstract and claims, especially 1-10.

In Zhang et al (937) for further relevant teaching, see abstract; Fig. 1+; col. 4, lines 1-32 and 59-col. 5, line 20 and 58-col. 6, line 52, noting both thermal and radiation treatment appear

to be taught to convert the amorphous area entirely to crystalline with col. 5, lines 5-10, discussing heating to 600°C in conjunction with using laser light. Particularly see, col. 9, lines 15-45 for α-Si with Ni to promote crystallization where first heating at 550°C in N_2 or Ar for 4 hrs is taught, then lines 46-59 where laser light is taught to "further promote" crystallization, which is consistent with applicant's claimed limitations. Lines 55-59 discuss the effect on dangling bonds and reduction of defects. Col. 9, line 60-67 give the next step which includes heating of the entire substrate from 300°-550°C, hence will also inherently fulfills the claimed thermal annealing which can also be a post-treatment step. Furthermore, in the making of devices, after ion implanting (claim 10, lines 20-41), laser annealing is preformed again (col. 10, lines 42-67) and then it is taught that "it is important that dangling bonds caused in the process of light annealing....are neutralized by heating them at a temperature of from 250° to 400°C in the atmosphere of hydrogen in a later process" (col. 11, lines 12-16), hence cumulatively showing this concept. Note that Zhang's process involves patterning after the annealing, which is consistent with the concepts of claims 41 and its dependents.

Given that CPU stands for central processing unit, i.e. a computer, such devices are full of semiconductor devices containing basic structures as claimed here, hence it would have been obvious to one of ordinary skill to use such device as made by the processes discussed here for their typical purposes.

7. Claims 50-51, 53-55, 69-74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitanaga et al P.N. 5,808,321 (supplied by applicant in the IDS 1/4/99 and has a filing date of ~~6/7030~~ (6/07/94).

Claims 76-92 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Mitanaga et al.

Mitanaga et al teach using impurities that are metals (In, Sn, Sb, Ge, Tl, Pb, Bi, Z, plus various the group III, IV and IV elements, column 3, lines 1-49) as catalyst for crystallization of amorphous Si. Col. 4, lines 15-57 mention sputtering, vapor dispositions and ion implanting gas techniques for deposit of the catalyst. Embodiment 1, especially on col. 10, line 16-col. 11, line 38, gives the example of In, first heat treated in H_2 at 550°C, then lamp (IR) or laser (KrF, XeCl, excimer) treated to promote crystallization. Then follows a silicon oxide formation, followed by a heat treatment, the repeat of the lamp heating (IR), which further improves the crystal properties. Thereafter, a number of steps (col.12, lines 33-43) a hydrogen anneal is performed on the entire substrate. Atmosphere and temperature are not given for the repeat treatment, however unless otherwise specified, one of ordinary skill in the art would assume that an atmosphere inert to the surface was used, making N_2 obvious. As the surface is heated due to light absorption, temperatures above 450°C and consistent with previously taught anneal temperature would have been expected. The second embodiment shows that an analogous semiconductor film may be patterned and undergo island formation (col. 14, lines 3-16 & fig.3), formation of a plurality of such features on a semiconductor substrate would have been obvious as a standard production procedure as discussed above. See CPU discussions above.

8. The reference to Makita et al in the IDS of 1/28/02 have teachings equivalent to Ohtani et al as applied above, but also have filing dates between applicants' filing date and foreign priority date, hence would also not be prior art if all New Matter was removed from the claims.

9. Applicant's arguments filed 1/28/02 and discussed above have been fully considered but they are not persuasive.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication should be directed to M. L. Padgett at telephone number (703) 308-2336 on M-F from about 3am-4:30 pm, and FAX #872-9310 (official); 872-9311 (after final); or 305-6078 (unofficial).

Padgett/af
June 4, 2002

June 4, 2002

MARIANNE PADGETT
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